Teaching Science and Math though Hands-on High Technology – Robert Salisbury

Current use of Technology

I use applied technology as a teaching tool and a motivator to reinforce learning, to introduce new concepts, and to provide an alterative method for students to ask questions or communicate information. Students use technology to explore the past, examine the present, and simulate the future. Technology in my classes generates interest, discussion, exploration and knowledge in all students. In 1998 I began to teach "real world" scenario based technology to classes as part of the Kamiah School District grades 9-12 Professional/Technology program. In 2003 these offering expanded to grades 7-12 and focused on integrating of technology in math and science, using current topics and hands-on activities, and motivating students to become better learners and problem solvers. Utilizing a variety of hardware and software tools students use applications to express themselves via the web; interact in the environment through robotics and computer programming; to relate math and physical concepts by designing games; explore the valley we live in with the aid of computer modeling; and witnessing the effects of such things as forest fires while changing the outcomes via computer simulations.. Students can make mistakes, learn life lessons, even burn down Kamiah and not hurt anything all with technology. Students begin to understand the relationships between math, science, technology and the real world

I have taken a paperless approach to my standards based lesson delivery. A Smart (white) board is used to demonstrate the concepts and to allow the students to clarify, interact with and enhance upon the learning. Office suite software components are not only taught in my classes, they are immediately reinforced by applying the concepts to projects the students are working on in my or other classes. Students seldom forget homework or lose assignments because almost everything is delivered to them and received from them electronically through the custom application E-Desk. Students in my classes are surrounded by the limitless possibilities of technology tools, from natural speech/text translation to the Internet.

I propose to further improve learning by allowing students of my classes to create *NEW*, innovative technology to enhance select science and math activities. The expected outcome will be to motivate, increase problem solving, utilize math and science, and educate students in innovative methods of data collection and analyst. Various grants have enabled the purchase of computers, printers, Smartboard, projectors, robotics and software to enable students in the program to have access to current technology. The activities provided with the use of these tools have helped the students reach a higher level of technology understanding in the classroom than was possible without the support. I propose to expand this base even further so students go beyond an understanding of existing technology tools and learn to create and utilized new tools in a "hands-on", "real-world" research project to re-establish the extinct salmon population in Lawyers creek, which boarders the school grounds. Through a combination of science, math, technology, reading and writing, this project will enable students to conduct experiments in data collection and retrieval in and compare and discuss their results with two local fish hatcheries, the Nez Perce tribal hatchery and Dworshak National Fish Hatchery.

Technology Impact on Student Performance

Student attitude about science, math, and technology has improved as a result of my usage of technology in the classroom. Student understanding and attitude toward of science and math concepts taught to date were compared to those before I began integration. Though most students still disliked science they had a greater appreciation and understanding of the concepts being taught with reinforcement and technology. No quantitative direct data can show if increased math scores are improving due to the addition of technology, however 73% of students questions stated that they could apply concepts learned in math class better after the concepts were reinforced with technology.

The procedure has proven to be highly effective; since I have began using technology to create a link between math, science and the real world not only have the students' understanding of these subjects increased but the students' technology skills and problem solving abilities have grown by an average of 240%. Currently over 120 students are impacted directly through the Kamiah technology program and more than 200 indirectly. Moreover, each of the students has impacted other students, parents and the community with whom they are associated. The "spin-off" of the program has lead to a number of related projects for teachers and students alike. The cost in time and money of utilizing a hands-on, "high tech" approach to reinforce concepts taught in sciences and math has proven to be a worthy investment with countless payoffs. Thus, for me, technology has become a wonderful tool to provide an exciting learning environment to the majority of students.

Budget Narrative

Previous grants have provided the software, computers, laptops, GPS units and the foundational components of the robotics required for this project. However the construction materials, (such as the PVC piping used in the shell and Plexiglas); data logging hardware; environmental sensors; power source and dolly, project specific electronic kits such as the Memsic 2125 Dual-axis Accelerometer, used to measure speed or spin of the probe; serial cable to provide feedback from the probe to a laptop; and a mini-camera for underwater imaging will be required to successfully implement the project goals and objects. I plan to construct 5 units which will provide a student to probe ratio of 5 to 1 in any given class. Though the full project might be purchased as a kit this would negate one of the primary objectives; problem solving and documentation. The core electronics will be purchased as kits to insure the eventual success and validity of the data. Two student build ROV's (remotely operated underwater vehicles) will be used to support this project and recover the probes if lost or damaged while in the water. Total planned cost for five probe units will be one thousand nine hundred forty five dollars ($1945.00).

Description of the project

I intend to have students collect weekly water data and visual images of Lawyer creek utilizing student designed , constructed computerized, and programmed robotic data probes. Students will learn about the habitat, water issues, biology as well as the technical issues of problems solving, data collection, data analysis, GPS, computer modeling, and result reporting. These activities will include learning about water and soil temperature; GPS mapping and 3D modeling; flow and depth; electrical conductivity and impurity counts, and water clarity and light level. All of which will be used to create a database over time. The underlying causes of differences over time and impacts on society will also be under investigation. This project will incorporate all six technology standards and all sub levels.

I also intend to have students collect visual information of the creeks current bed conditions, how many pebbles and of what sizes in representative areas. This will be done by an onboard camera built into each probe and the same skill learned in transaction. These activities along with water clarity results will allow students to make comparisons to the bed before and after the Army Corps of Engineers complete a dredging project to slow the waters flow as well as after major storms re-sculpt the bed.

Additional projects will be developed with the equipment intended, such as with my introductory Computer Systems Courses and my Advanced Networking program. These will include teaching upper level problem solving methods and scientific research at a basic level in a way that is interesting to almost all students. This equipment will also be used as a tool to provide exposure to technology to students who traditionally shy away. All the data collected will be utilized in the Salmon recovery project and is share via the web with the community and the Salmon recovery project partners.

Upon completion of the probes it is my intension to share these resources with the math and science departments. This will include training on how they work, what kinds of data they can collect and how to interpret the data.

Qwest Foundation for Education Grant Expenditure Plan
(Standard IFARMS Budget Form)

Activity	100 Salaries	200 Benefits	300 Contractual Agreements	400 Materials	500 Capital Objects	**TOTAL**
5 Memsic 2125 Dual-axis Accel. 5 Mini-cameras 5 Applied Sensors Kits 10 Servos 5 Deep Cycle Batteries and Dollies 1 3”x10’ PVC pipe and Caps (10) 4 Sheets 4’x4’ PlexiGlas 5 Controller buttons (4pk N.O.) 5 Serial connectors sets 200’ Tether cable Misc eletronics (resistors, relays etc.)				$150.00 $300.00 $400.00 $200.00 $400.00 $75.00 $40.00 $30.00 $25.00 $25.00 $300.00		
TOTAL				$1,945.00		$1,945.00